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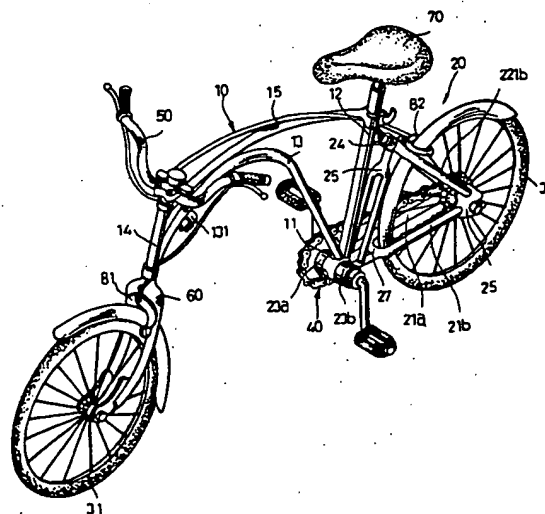
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D-80336 München (DE)(54) **A collapsible bicycle.**

(57) A collapsible bicycle comprises a frame (10), a front (31) and rear (32) wheels rotatably attached thereto, and a drivetrain (40) for transmitting torque to the rear wheel, with the frame including a movable structure (20) on which the rear wheel is attached. The frame carries a pair of lower stay elements (21a,21b) on a lower portion thereof and a fork member on an upper portion thereof with the prongs of the fork member defining a pair of upper stay elements (221a,221b). The front ends of the lower stay elements are adjoined with respective pivot rings (23a,23b) attached to a bottom bracket of the frame so as to enable the rotation of the movable structure thereabout, while the male and female elements of a quick-release type connector are provided on the shank portion of the fork member and an upper portion of a seat tube of the frame to enable the fixing of the movable structure thereto. The frame is further provided with an arcuate down tube (13) adapted for the positioning thereunder of the rear wheel and movable structure when the bicycle is in a compacted form. This being accomplished by first disconnecting the fork member from the frame and then rotating the movable structure about

the bottom bracket until the rim of the rear wheel is in proximity with the down tube.



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The rear ends of upper stay elements 221a,221b and lower stay elements 21a,21b adjoin respectively at a pair of dropout plates 25 on which the axle of rear wheel 32 is carried. The connection between fork member 22 and lower stay elements 21a,21b is reinforced by a fork like cross member 26 adjoined therebetween so as to increase the rigidity of the movable structure. The shank of the cross member adjoins with fork member 22 below the juncture portion thereof and the prongs adjoin with respective lower stay elements 21a,21b near bracket 11 so that the movable structure assumes a generally triangular plan form. Similarly, a tubular cross element 27 traverses lower stay elements 21a,21b being adjoined therebetween to increase their resistance to lateral divergence.

As shown in Fig. 5, pivot rings 23a,23b and bottom bracket 11 are generally cylindrical in form and have equal diameters. A two piece, threadedly coupled journal sleeve 111 positioned therein holds the pivot rings and bottom bracket together with the journal sleeve being fixed to bottom bracket 11 by a radial screw 111a passing therethrough. The flanged outer ends of journal sleeve 111 rotatably position pivot rings 23a,23b therebetween. As with conventional bicycle drivetrains, a crankaxle 112 having pedal carrying cranks 113 attached to the opposite ends thereof is rotatably secured within the journal sleeve in the conventional manner using ball bearings 114, a cone 115, and a locknut 116 on either side thereof. A chainwheel 117 is also fixed to one side of the crankaxle for engaging the drivetrain of the bicycle.

Figs. 6 and 7 detail the quick-release type connector used to fix the movable structure to frame 10, wherein a tubular extension 241 which is pivotably attached to seat tube 12 below the juncture of the top tube therewith by a clevis joint 121 engages a shaft member 242 provided on a shank portion of fork member 22. A plurality of balls 243 are disposed in a set of radial apertures formed around the extension 241 which have inner cross-sections significantly narrower than the diameter of the balls so as to prevent their passage therethrough. The tubular extension and a retaining ring disposed around the free end thereof. Compression spring 245 urges the sleeve member towards a position whereat a smaller diameter internal section therein is in registry with the apertures of extension 241, causing balls 243 to protrude radially inwards and obstruct the interior passage of the tubular extension.

Shaft member 242 can be inserted into extension 241 by first retracting the sleeve member to a position whereat a larger diameter internal section therein is in registry with the apertures of the extension, allowing the outward expansion of the balls caused by the passage of the shaft member

which has a tapered forward end. After the free end of extension 241 is brought into abutment with the adjoining base of shaft member 242, the sleeve member is allowed to travel forward under the biasing action of spring 245 so as to once again cause balls 243 to protrude radially inwards and engage a cooperating circumferential groove 242a on the shaft member. This blocks further movement of the shaft member relative to the extension and locks movable structure 20 to frame 10. The shaft member can be disengaged from the extension by again pulling back the sleeve member so as to allow expansion of the balls caused by the camming action of groove 241a during the retraction of the shaft member.

After the upper portion of structure 20 is disconnected from frame 10 as described above, the movable structure and attached rear wheel 32 can be rotated downward and around bottom bracket 11 so as to position the rear wheel under an arcuate downtube 13, as shown in Figs. 8 and 9. The downtube has a form adapted for receiving the wheel and movable structure thereunder and has an elastic C-shaped clamped 131 fixed to the underside thereof which engages the rim of wheel 31 to hold the movable structure in position. Front wheel 31 is skewed relative to the frame so as to not interfere with the positioning of the rear wheel and movable structure.

The collapsible bicycle is thus rendered into a compacted form that can easily be stored. The movable structure can be re-extended to the rear of the frame by releasing the rear tire from clamp 131 and rotating the movable structure in a counterclockwise direction so as to re-engage shaft member 242 on the fork member thereof with the aligned extension 241 on the seat tube, the pivoted extension adapting to the varying angle of engagement of the tilting shaft member.

Though the above description and accompanying drawings includes many specificities, these should not be construed as limitations on the scope of the present invention but are merely one mode of realization of a preferred embodiment thereof. Many variations and modifications to the present invention could readily be accomplished by a person skilled in the art without departing from the spirit or scope thereof.

As an example, though a purely rotational engagement between the lower portion of the frame and attached movable structure were described for the above embodiment, a more general pivotable engagement wherein the angular orientation of the movable structure relative to the frame could be significantly varied about more than a single axis could also be attained. Accordingly, the adaptation of the frame members could then also be cooperatively altered.

member is in registry with said apertures;  
a shaft member provided on said upper portion  
of said movable structure said shaft member  
being insertable into said tubular extension and  
having a circumferential groove formed thereon  
adapted for engaging said blocking elements.

8. A bicycle according to claim 7, wherein said  
tubular extension is pivotably attached to said  
frame.

9. A bicycle according to claim 8, wherein said  
movable structure further includes a fork mem-  
ber provided on an upper portion thereof, said  
fork member having a pair of prong like upper  
stay elements with the free end portions there-  
of carrying the axle of said rear wheel, said  
shaft member of said connecting means being  
fixed to the shank portion of said fork member.

10. A bicycle according to claim 9, wherein said  
movable structure further includes a reinforcing  
means provided between said fork member  
and said lower stay elements for strengthening  
said movable structure.

11. A bicycle according to claim 10, wherein said  
reinforcing means comprises a fork like cross  
member having a pair of prongs adjoining with  
respective said lower stay elements and a  
shank portion adjoining with said fork member  
below the juncture portion thereof.

12. A bicycle according to claim 1, wherein said  
frame includes an arcuate tubular member dis-  
posed between said front wheel and a front  
portion of said drivetrain, said tubular member  
being adapted for the positioning thereunder of  
said rear wheel and said movable structure  
after said upper portion of said movable struc-  
ture is disconnected from said second fixed  
portion of said frame and said movable struc-  
ture with said rear wheel are moved about said  
first fixed portion of said frame.

13. A bicycle according to claim 12, further com-  
prising a support means for holding said rear  
wheel and said movable structure in position  
under said tubular member.

14. A bicycle according to claim 13, wherein said  
support means comprises an elastic roughly C-  
shaped clamp element fixed to said tubular  
member, said clamp element being releasably  
engageable with a rim portion of said rear  
wheel.

15. A bicycle according to claim 1, wherein said  
connecting means comprises:

a tubular extension provided on said second  
fixed portion of said frame, said tubular exten-  
sion having a plurality of apertures formed  
radially thereon;

a sleeve member slidably retained on said  
tubular extension, said sleeve member having  
a stepped internal diameter;

a plurality of blocking elements positioned in  
respective said apertures, said blocking ele-  
ments being projected radially inwards through  
said apertures when in abutment with a smaller  
diameter section of said sleeve member in  
registry with said apertures, and outwardly ex-  
tensible when a larger diameter section of said  
sleeve is in registry with said apertures so as  
to not obstruct the inner passage of said tubu-  
lar extension;

a spring element urging said sleeve member in  
an axial direction towards a position whereat  
said smaller diameter section of said sleeve  
member is in registry with said apertures;

a shaft member provided on said upper portion  
of said movable structure said shaft member  
being insertable into said tubular extension and  
having a circumferential groove formed thereon  
adapted for engaging said blocking elements.

16. A bicycle according to claim 15, wherein said  
tubular extension is pivotably attached to said  
frame.

17. A bicycle according to claim 16, wherein said  
movable structure further includes a fork mem-  
ber provided on an upper portion thereof, said  
fork member having a pair of prong like upper  
stay elements with the free end portions there-  
of carrying the axle of said rear wheel, said  
shaft member of said connecting means being  
fixed to the shank portion of said fork member.

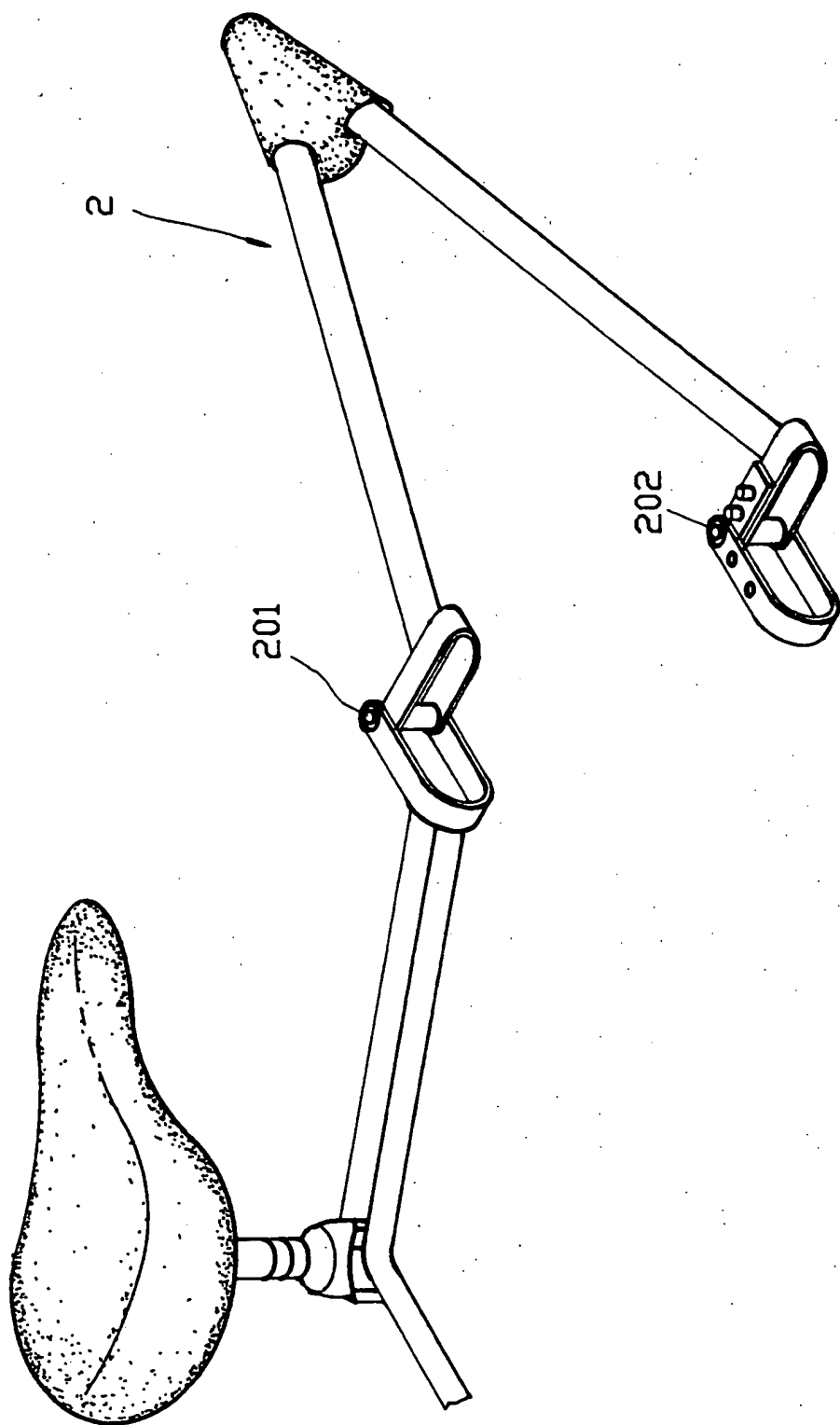


FIG 2

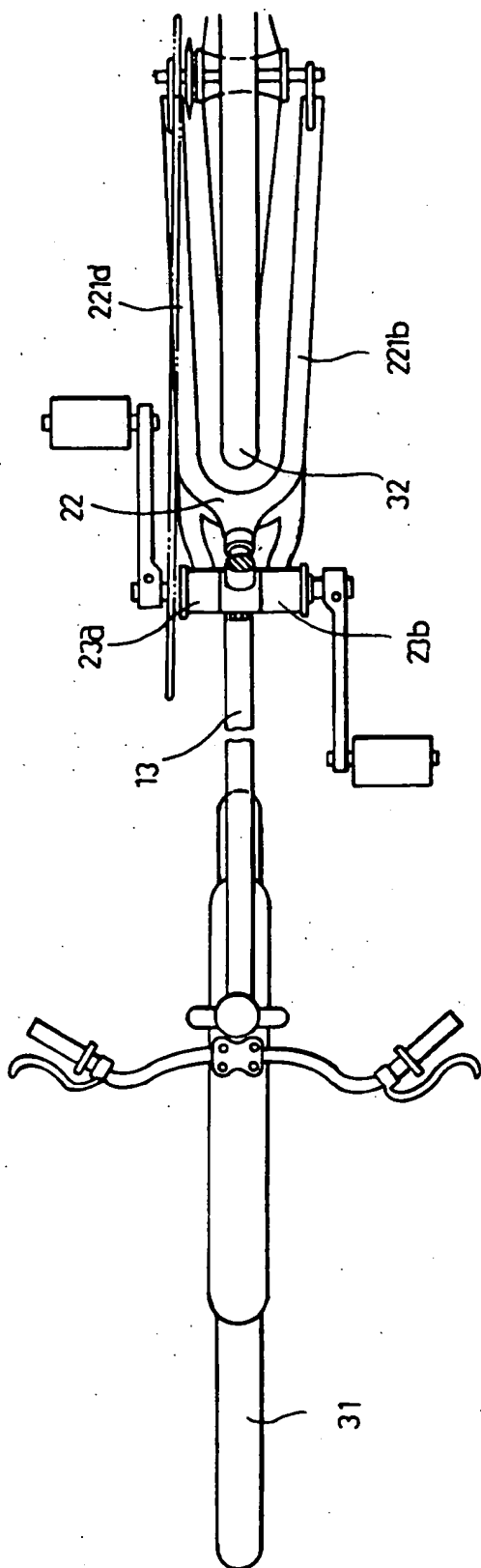
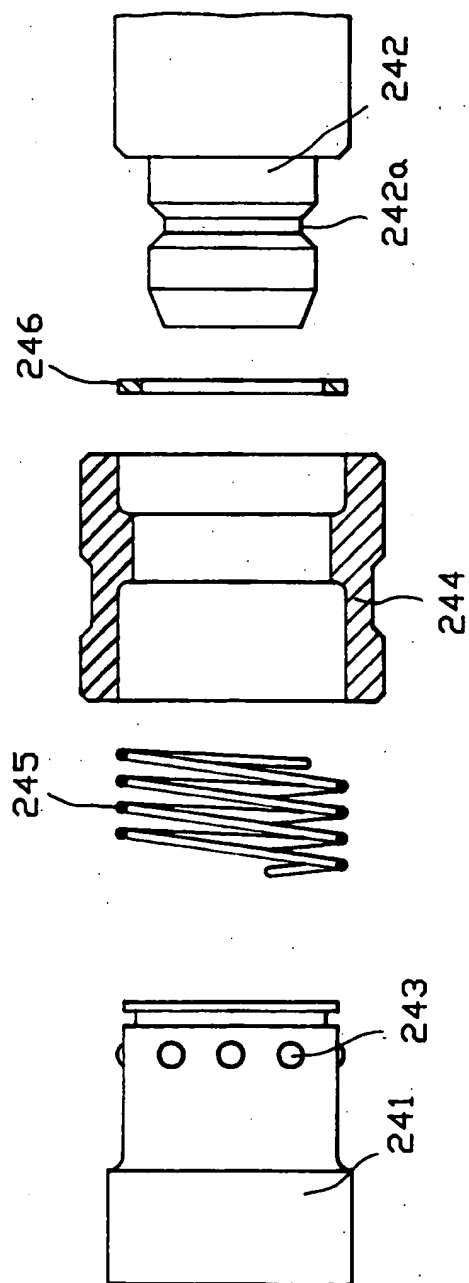
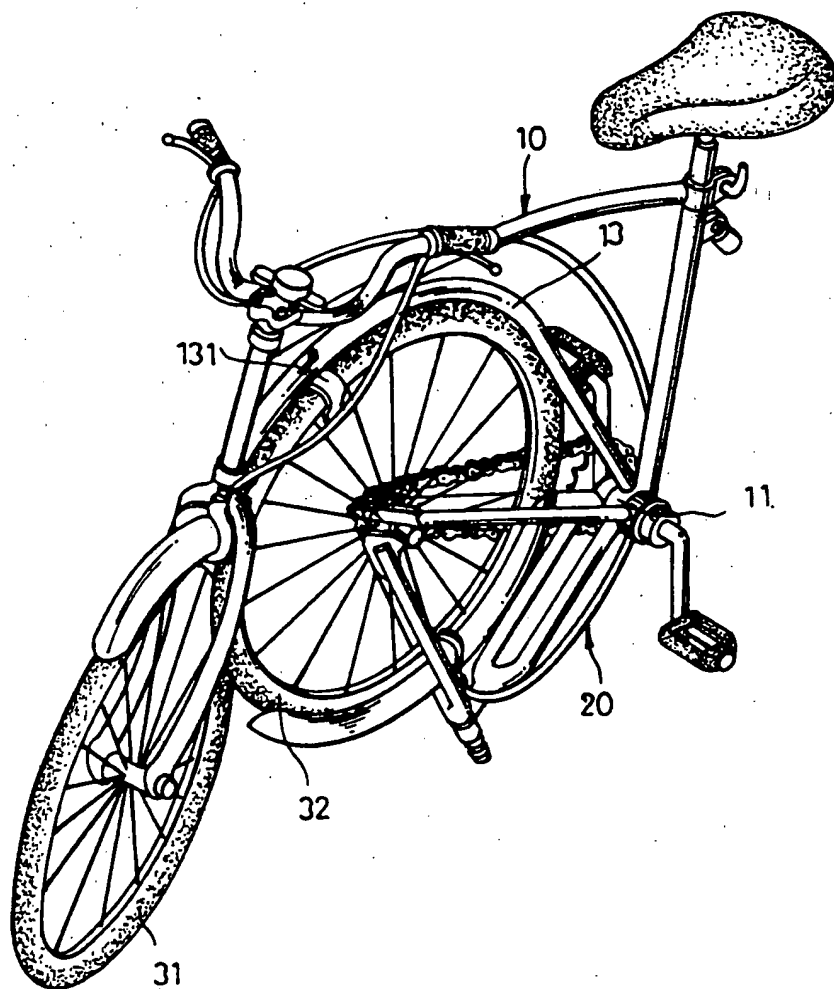


FIG. 4



F I G 6



F I G. 8



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## EUROPEAN SEARCH REPORT

Application Number

EP 92 10 6551

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	BE-A-628 783 (M. RAIMONDI) * the whole document *	1-5	B62K15/00
A	---	9-11, 14, 17	
X	DE-A-3 929 296 (ENGELBERT WIENER GMBH) * the whole document *	1, 15-17	
A	---	7-9	
X	WO-A-8 805 394 (U. BOGEN) * page 8, line 28 - page 10, line 2 * * page 10, line 22 - page 11, line 15; figures 1, 2, 4, 5 *	1-5	
A	---	9, 17	
X	FR-A-883 836 (SOCIÉTÉ NATIONALE DE CONSTRUCTIONS AÉRONAUTIQUES DU SUD-EST) * the whole document *	1, 9, 17	
A	---	1, 6, 12, 13	
	EP-A-0 012 604 (J. SZUMOWSKI) * the whole document *		TECHNICAL FIELDS SEARCHED (Int. Cl.5)
	-----		B62K
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 02 DECEMBER 1992	Examiner CZAJKOWSKI A.R.
<b>CATEGORY OF CITED DOCUMENTS</b>			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ----- & : member of the same patent family, corresponding document	